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Sustainable Development Goals: a framework for deploying indicators for higher education institutions

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Abstract

Purpose: This paper aims to analyse the extent to which the Sustainable Development Goals (SDGs) are being considered at Higher Education Institutions (HEIs) and propose and test the possible acceptance of a list of indicators to evaluate the contribution of HEIs to the SDGs.

Design/methodology/approach: The methodology consisted of the collection of indicators of sustainable development based on existing bibliography. Afterwards, a set of indicators related to the SDGs were selected, based on the most frequent SDGs' expressions found in the selected indicators. A sample of researchers was also asked to indicate to which extent this set of indicators is perceived as relevant.

Findings: The results indicated an initial list with 432 indicators, of which 268 were selected for having at least one of the keywords searched for, related to the SDG descriptions and targets. Thus, redundant indicators were excluded and, when necessary, indicators were aggregated, resulting in a final list of 61 indicators.

Originality: The set of indicators resulted from this analysis was considered appropriate to evaluate the contribution of HEIs towards the SDGs, demonstrating that it might not be necessary to create new indicators for that purpose.

Keywords: 2030 Agenda; performance; evaluation; HEIs; indicators; sustainability.

1 Introduction

The discussion on sustainable development has intensified since the 70's involving a set of efforts, conferences and global actions. As these debates advance, numerous solutions and oppositions have arisen on how to contribute to sustainable development (Mebratu, 1998; Clugston and Calder 2000; Lozano *et al.*, 2013; Slaymark 2018).

Recently, in the 2000s, the Millennium Development Goals (MDGs) were developed. Planned to be achieved between 2000-2015 (UNDP, 2019), they provided the structure for a historic and effective scheme of worldwide mobilization, in order to develop the main goals relating to global social priorities, such as poverty, education, disease, hunger, inequality, and environmental degradation. Following the period of the MDGs, a subsequent set of 17 Sustainable Development Goals (SDGs) were established through the 2030 Agenda, with 169 targets to be achieved by the year 2030. The SDGs represent a plan of action for people, planet and prosperity, aiming at changing how societies and economies operate and interact with our planet (Sustainable Development Solutions Network-SDSN, 2017).

Since the establishment of the SDGs, several actors (such as the public sector, private sector, academia, civil society and the media) have worked towards achieving the goals. One of the strengths of the SDGs concerns the data revolution, an item identified as flawed after an analysis of the MDGs performance (Balogh, St-Pierre and Pippo 2017). In the SDGs, there is a focus on efforts to address this gap through specific groups: the commitment of academia, for example, is highly expected in terms of provision of scientifically grounded information.

To assess the level of contribution to the SDGs, performance evaluation by metrics is required. In this sense, indicators are presented as a useful tool in this process. For example, the SDSN (2017) stated that Higher Education Institutions (HEIs) play an imperative role in this challenge, since they retain the capacity to produce and spread knowledge which is essential to the world's economy (Burbridge, 2017). In the case of the SDGs, there is a working group focused on selecting and updating indicators: the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) linked to the United Nations. As of March 2017, 232 official indicators related to the targets have been defined, with 9 of them appearing in more than one goal (United Nations, n.d).

However, the indicators listed are not versatile enough to be used directly in different contexts, as in the case of HEIs. Despite the undisputed relevance of HEIs to the 2030 Agenda, assessing how they will play their role in helping meet the 17 SDGs remains a challenge. Given the importance of the participation of HEIs in promoting and assisting in the fulfilment of SDGs' targets, there is also the need to measure their contributions. As the official indicators of the 2030 Agenda cannot be applied directly to HEIs, this paper aims to analyse and propose a list of indicators to evaluate the contribution of HEIs to the SDGs.

Other authors have been investigating the role of education and particularly of HEIs in advancing the SDGs, but mostly from the perspective of systematic reviews (Abad-Segura and González-Zamar, 2021; Avelar et al., 2019). As indicated by Leal Filho et al. (2021), although much progress has been observed in embedding the SDGs into HEIs, one of the gaps is still "the need to define reliable indicators, which may ascertain the extent to which specific sub-goals have been reached" (p. 10).

The contribution of the study is twofold: it shows that HEIs have been contributing to topics related to the Sustainable Development Goals even before 2015, and that there is no need to create new indicators to assess this contribution. The novelty of this exploratory study relies on the proposition of a set of indicators to directly connect

university efforts and their contributions to the 2030 Agenda. To do so, this paper relates literature reviews of existing sustainability indicators to the SDGs.

2 The role of HEIs and the SDGs

When it comes to sustainable development, HEIs are highly influential in raising awareness. It is essential to discuss and approach the theme in the context of these institutions, in their educational, management and operational aspects (Nishmura, 2015).

According to Professor Jeffrey Sachs, in his position as special adviser to UN Secretaries-General Kofi Annan and Ban Ki-Moon, “the pathways to sustainable development will not be identified through a top-down approach, but through a highly energized era of networked problem solving that engages the world’s universities, businesses, nongovernmental organizations, governments, and especially young people, who should become the experts and leaders of a new and profoundly challenging era” (Sachs 2012, p.2211). Nevertheless, this is not a new topic for HEIs (Neubauer and Calame 2017). In 1977, the promotion of environmental education in these institutions was addressed through the Tbilisi Declaration, published by the Intergovernmental Conference on Education. In 1990, the Talloires Declaration sought to understand the indispensable actions needed to implement sustainable development in HEIs (Berchin, 2017). Recently, UNESCO promoted the Decade of Education for Sustainable Development, from 2005 to 2014, with great impact worldwide (UNESCO, 2014).

For years HEIs have been assuming their integral position and role as promoters of sustainable development. Soini *et al.* (2018) corroborate this by indicating that the number of universities with sustainability centres has increased, which demonstrates the commitment of these institutions in the search for specialized actions for the cause.

In their research, Lozano *et al.* (2015) confirm that HEIs have been struggling to implement sustainable development. They tend to do so in a compartmentalized way, when the indication is that the implementation should be carried out holistically. Therefore, the challenge for higher education leaders is the integration of sustainable development within the activities of the institution. Not only is integration a challenge, but HEIs also face other barriers when trying to transition to sustainability within their daily activities and operations, including constraints linked to resource availability, technology, and institutional culture (Ávila *et al.*, 2017).

One of the major responsibilities of HEIs lies in the fact that they prepare the future generation of politicians, administrators, scientists, philosophers, and other actors who will be entrusted with the construction of our world (Neubauer and Calame, 2017). Because of this, there is a need for sustainability to become a part of teaching and research, and not merely a part of campus operations (Ávila *et al.*, 2017).

As stated by SDSN (2017, p.9), “the interaction between HEIs and SDGs also brings benefits to HEIs, since new partnerships will be created, access to new funding flows, demand for SDGs-oriented education and definition of a responsible and globally conscious HEI”. Particularly, applying the SDGs in higher education can be an opportunity for starting interactions on cooperation among HEIs sectors and degrees, and between the general public and the HEI (Albareda-Tiana *et al.*, 2018). As indicated by

Neubauer and Calame (2017), the SDGs should be used as a unique opportunity to strengthen and intensify sustainability dynamics in HEIs around the world.

It is noticeable that HEIs are gradually incorporating SDGs and other commitments related to them into their current policies and plans. The University of Melbourne, Australia, for example, stated in its 2015 Report that they would include their SDGs actions in their upcoming annual sustainability reports (University of Melbourne, 2015). Another example is the Università di Bologna, which published a report on the UN Sustainable Development Goals in 2016 (Università di Bologna, 2017) affirming its commitment. Since then, many universities have included the SDGs in their annual reports. Presently, the “Times Higher Education Impact Ranking” is the only global performance framework which assesses universities' contribution to the Sustainable Development Goals (Times Higher Education, 2020). To measure that, each goal has indicators in four areas (research, stewardship, outreach and teaching). SDG 1, for example, includes indicators such as number of publications related to poverty, targets to admit students who fall into the bottom 20% of household income in the country, and training or programmes to improve access to basic services for all.

As for the transition to action in the current context of SDGs, it is understood that there is no standard way for an institution to engage with them, as this will depend on their size, context, research and educational strength, availability of funding, values, priorities, and the needs of the communities in which they operate (SDSN, 2017). The SDSN (2017) provides five steps to reinforce universities' engagement with the SDGs, as follows: (1) - Mapping what universities are already doing; (2) - Building capacity and ownership of the SDGs; (3) - Identifying priorities, opportunities and gaps; (4) - Integrating, implementing and embedding the SDGs within university strategies, policies and plans; and (5) - Monitoring, evaluating and communicating universities' actions on the SDGs.

Thus, HEIs stand out among the agents participating in this change for occupying a unique position within society. They have a broad domain around science and the dissemination of knowledge, acting as promoters of innovation, economic development and social well-being (SDSN, 2017; Soini *et al.* 2018). Regarding the SDGs, HEIs have the function of technology incubators and expertise disseminators. They are able to speed up the transmission of worthy ideas, to have pioneering tactics and to direct actions on the way of best practices to complete the established goals (Sachs, 2015).

Innovation, leadership, education and research will be crucial in assisting society in addressing these challenges. HEIs, with their vast ability to construct and propagate knowledge, and their irreplaceable spot within society, have a critical duty to fulfil the success of the SDGs (SDSN, 2017).

2.1 Keeping up with HEIs' contributions

As Step 5 above recommended (SDSN, 2017), it is imperative to share the experiences of applying the SGDs in the context of HEIs, especially when it reflects the initiatives taken. Therefore, aiming to verify the occurrence of progress and evolution of these initiatives, it is integral to have data that measures what is being done. Given this,

the indicators are presented as metric tools that help in the collection of data that can be analysed and will aid in the decision-making process.

Because the 2030 Agenda and the goals are relatively recent, reporting guidelines through which organizations can monitor and share their performance are not yet well defined (SDSN 2017). Despite this, one of the elements that are expected to be part of the reports is the use of indicators. These indicators are referred to by Alghamdi *et al.* (2017) as one of the most suitable tools for measuring and monitoring practices and performance. Neubauer and Calame (2017) discuss how the indicators are part of the argumentation of stakeholders to technically justify their decisions.

The use of sustainable development indicators that assist in the decision-making process is highlighted in Chapter 40 of Agenda 21, entitled "Information for decision-making" (United Nations, 1993). They are also highlighted by post-MDG analysis as relevant to the monitoring and success of Global Agendas (United Nations, 2015a). Once the criteria for choosing the indicators have been established, they can be used to monitor different contexts, such as the evolution of SDGs and the initiatives adopted in HEIs.

There are a great number of possible indicators to evaluate the sustainability of HEIs, since they can address 4 fields: education, operations (in this article separated as campus [operations] and management), research, and community outreach (Fischer, Jenssen and Tappeser 2015), as well as the possibility of addressing sustainability as a whole or only one of its dimensions: environmental, economic or social.

Disterheft *et al.* (2016) believes that evaluation processes should be stimulators of reflection, discussion and change, rather than as a control tool. In addition, they add that participatory approaches are important for assessing sustainability in the context of HEIs. Neubauer and Calame (2017) discuss the relevance in the process of creating indicators, stating that it can be as important as the indicators themselves. Thus, each HEI can determine its own list of indicators which compose the evaluation of its performance towards sustainability.

3 Methodology

3.1 Gathering sustainability indicators already known and used by the universities worldwide

The search for sustainable development indicators applied in HEIs has been developed through a bibliographical review, using the database Web of Science and the following search string: ("assessment tools" OR "indicators" OR "report" AND "sustainable development" AND "higher education institutions"). Peer-reviewed articles, published in English and between the time span of 2009-2019 were the selection criteria. They had to be self-explanatory (no need to consult additional documents or manuals) and be presenting assessment tools or literature reviews.

The search resulted in the main sources listed in Table 1, encompassing 432 indicators. Since the selected papers represented consolidated assessment tools and reviews papers, they already compiled the most used indicators concerning sustainability.

Therefore, additional extensive search was not conducted. The main purpose was relating those existing indicators to HEIs and the SDGs.

Table 1. List of sources consulted for lists of indicators

Author	Title	Type of article	Based on:
Aleixo, Azeiteiro e Leal (2018)	The Implementation of Sustainability Practices in Portuguese Higher Education Institutions	Empirical / Review article	Aleixo et al. (2016); Alonso-Almeida et al. (2015); Disterheft et al. (2013); Fischer et al. (2015); Larran Jorge et al.(2015); Lozano (2011); Lozano et al. (2015); Assessment tools: AISHE; CITE/AMB; CSAF; DUK; GASU; GMID; STARS and STAUNCH.
Ceulemans, Molderez e van Liedekerke (2015)	Sustainability reporting in higher education: a comprehensive review of the recent literature and paths for further research	Review article	Beringer (2007); Ceulemans et al. (2011); Dlouhá et al. (2013); Glover et al. (2011); Koehn and Uitto (2013); Lozano (2010); Lozano (2011); Lozano and Young (2013); Lozano (2006a); Lukman et al. (2010); Madeira et al. (2011); Moon and Orlitzky (2011); Setó-Pamies et al. (2011); Shi and Lai (2013); ULSF, s.d.; Waheed et al. (2011a); Waheed et al. (2011b); Waheed et al. (2011c); White and Koester (2012); Wright and Bennett (2011); Yarime and Tanaka (2012); Yuan and Zuo (2013);
Gómez et al. (2015)	AMAS - Adaptable model for assessing sustainability in higher education	Assessment tool	
Gómez Gutiérrez and Sepúlveda (2017)	Sustainability Indicators for Universities: Revision for a Colombian Case	Review article	Most reported indicators by the universities sustainability reports, under the GRI 3.1 methodology
Greenmetric (2015)	UI GreenMetric World University Ranking	Assessment tool	
Ruiz (2016)	Incorporation of Environmental and Sustainable Indicators in Universities	Empirical	
Sassen e Azizi (2018)	Assessing sustainability reports of US universities	Review article	Fonseca et al. (2011); Lopatta and Jaeschke (2014); Lozano (2011); Sassen et al. (2014); GRI G4
STARS (2017)	Sustainability Tracking, Assessment & Rating System	Assessment tool	
Togo e Lotz-sisitka (2009)	USAT - Unit-Based Sustainability Assessment Tool	Assessment tool	

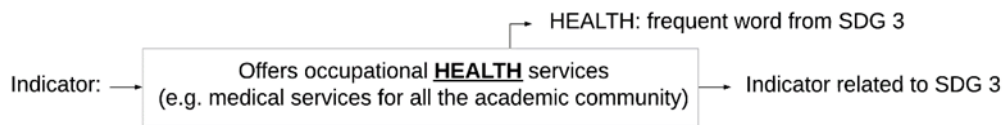
3.2 Relation among indicators and the SDGs

The second step consisted of relating the 432 indicators suggested by the authors from Table 1 to the SDGs, with support of the software *NVivo10* (Dollah, Abduh, and Rosmaladewi, 2017). The most frequent words¹ of each SDG were analysed, considering the text of their targets and indicators (Feil et al., 2019). Indicators that contained at least one of the most frequent words remained in the list, and the others were excluded (West,

¹ Some words are found with high frequency in more than one SDG but are not essential to define the topic of these goals. For this reason, these words (e.g. development, proportion and countries) were disregarded in this study.

2001). According to the origin of the word found in the indicator, the same would be related to a given SDG, as presented in Figure 1.

Figure 1. Example of relation between an indicator and a SDG.



Due to the limitation of the software search (for considering only the word itself and not a context), the authors felt it was necessary to verify the consistency of the selected indicators in connection to the SDG to which they were related. All indicators and their related SDGs were checked to confirm the established connections. Table 2 presents examples of the screening process to confirm or disregard the connection indicated by the software. A group of 268 indicators resulted from this step.

Table 2. Example of the screening process to check connections

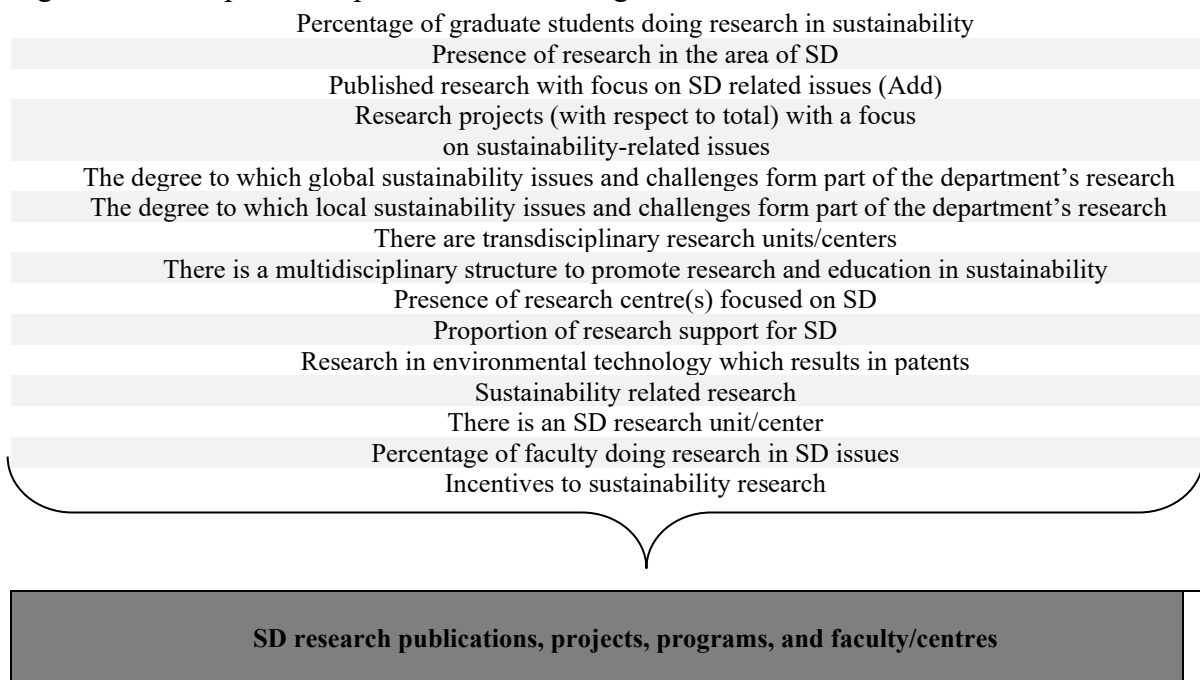
Indicator	Related SDGs indicated by NVivo	Related SDGs indicated by the authors	Description
Total weight of waste by type and disposal method.	12	12	Perfect compliance. The SDG indicated by the software is consistent with the description of the goal and its targets.
Policies related to sustainability in research	9, 10, 12, 17	4, 9, 16, 17	Partial compliance. Among the suggestions of the software, some were considered not coherent. Additional SDGs were added.
CO2 and air pollution reduction practices (including alternative fuel use, renewable energy sources, emission control devices, etc.)	7	7,13,15	Partial compliance. Additional SDGs were added given their connection with the indicator.
Promotes the purchasing of food products from local/regional suppliers	2, 6, 8, 11, 12	2, 12	Partial compliance. Some SDGs indicated by the software do not seem to be directly connected to the indicator.
Institution has engaged in a structured assessment process to improve diversity, equity, and inclusion on campus.	16	10	Noncompliance. Another SDG was considered as more directly related to the indicator.
Consulting and support services for students with children	2	-	Noncompliance. It was considered that this indicator does not have a direct relation with any SDG.

A new round of re-evaluation was proposed at this stage, in order to reduce the number of selected indicators (considering that many of them covered the same issue). An elimination by similarity in meaning was carried out through a focus group with 8 experts. The group was composed by sustainability researchers (specialized on the 2030 Agenda and the SDGs) at the postgraduate and graduate levels, who discussed the relevance and permanence of the remaining indicators (Kothari *et al.* 2011; Triyono 2015; Neuendorf and Kumar 2016). The choice of a focus group relies on its in-depth understanding of participants' perceptions about the subject (Shoaf and Shoaf, 2006) and

its versatility and productivity (Stewart and Shamdasani, 2014). Although typically involving six to ten participants, this approach allows multiple views about the subject (Litosseliti, 2003).

With the results of the focus group, some indicators considered to be of lesser relevance to the context of HEIs and of the SDGs were eliminated. Other indicators were combined, in order to make them more comprehensive and therefore reducing the number of indicators that would be considered in the following steps (Figure 2). The final list resulted in 61 indicators.

Figure 2 - Example of the process of combining indicators



This final list of indicators was then related to the SDGs (as presented in Figure 1 and Table 2) and classified according to HEIs dimensions: campus, teaching, outreach, management and research (Cortese, 2003; Fischer, Jenssen and Tappeser 2015; Amaral, Martins and Gouveia 2016; Slaymark 2018).

3.3 Checking the importance of the selected indicators

To verify the order of importance of the selected indicators and to evaluate the contribution of HEIs to a given SDG, a survey (see Appendix A, sent through Google Forms) was performed with a worldwide sample of specialists. All specialists were invited to voluntarily participate in the research.

Initially, members of the international network “Inter-University Sustainable Development Research Program” (IUSDRP) and Brazilian HEIs were invited to participate, so that the survey could have both global and national responses. The IUSDRP (<https://www.haw-hamburg.de/en/ftz-nk/programmes/iusdrp.html>) represents a group of specialists with the aim to “establish a platform in which member universities

may undertake more research on matters related to sustainable development, according to an agreed work plan and agenda” (HAW Hamburg, n.d.).

At first, a generalized approach was taken by sending standard e-mails, where each participant could choose which SDG to respond to. However, not all SDGs were addressed in this first approach. Thus, in the second round, emails containing invitations for a specific goal were sent to the experts, , according to their main research areas. For this personalized approach, the search for specialists was performed through the selection of authors who wrote articles connected to the topics of the SDGs. In addition to individual contacts via email, the ResearchGate platform was also used for direct message contacts.

The list of indicators was evaluated by 91 experts. Responses were received between November 2018 and February 2019 and had a worldwide scope since each continent was represented by at least one participant. The participating countries were Albania, Brazil, China, Colombia, Costa Rica, England, France, Germany, Ghana, India, Indonesia, Iran, Italy, Latvia, Liberia, Malaysia, Nigeria, Norway, Poland, Portugal, Spain, Turkey and United States, as shown in Figure 3.

Figure 3. Global distribution of the survey’s respondents



Likert scale measures (Gil, 2008; Jacques *et al.*, 2012; Silva Júnior, Costa, 2014) were used for the respondents to indicate the level of importance of each indicator towards measuring a specific SDG in higher education institutions. In order to rank the indicators, it was decided to present their score as a percentage (Bonici and Araújo Júnior, 2011; Almeida Júnior, 2017), as shown in the example of Table 3. Thus, each response was multiplied by the weight corresponding to its importance, and the final value was obtained through the relation between the total points obtained by the indicator and the highest value that it could get. The highest possible value corresponds to the number of

respondents multiplied by the highest weight. This approach was used as a standard in presenting the scores, regardless of the number of respondents per goal.

Table 3. Example of the process of scoring indicators

Scale of Importance	Distribution (n) of respondents according to the indicator importance (N = 10 respondents)	Score (importance x n)	Total Score (Sum)	Importance* (%)
1	0	0	44	$\frac{44}{50} = 88\%$
2	1	2		
3	0	0		
4	3	12		
5	6	30		

*The example refers to the indicator “The level of expertise of staff members in the area of sustainability” from SDG 4. Ten respondents (N=10) evaluated this indicator (using the Likert Scale from 1 – not important to 5 – very important); therefore, its maximum total score could be 50 points (10 respondents x 5 points). As it received 44 points, the importance in percentage is presented as 88% (44/50).

Aiming to obtain the highest possible number of responses, the questionnaire was divided into sections according to each SDG. Each specialist was asked to respond to one goal at a time. This was done because the total amount of pre-selected indicators would require a lot of response time, which may have resulted in response fatigue. The option to respond to more than one SDG was also available. The results allowed the evaluation of the indicators and resulted in a list of the most relevant ones.

4 Results and Discussions

4.1 Sustainability indicators selected

The literature review resulted in a list of 432 indicators that have been used in the last decades to monitor what institutions are doing towards sustainable development. The authors' approaches are diverse, having both quantitative and qualitative methodologies, and varied ways of classifying and subdividing the indicators (Berzosa *et al.*, 2017). The scope of the selected indicators covers all sectors of HEIs, including managerial and operational aspects, as well as the social responsibility of the institution and its relation with society.

After connecting these indicators with the SDGs, a group of 61 indicators were selected, as shown in Table 4.

Table 4. List of selected indicators

Code	Indicator	Related SDG	Suggested aspects for evaluation
i1	Contributions to the Community	1,8,17	Percentage of outreach programs/projects involving community
i2	Financial and non-financial support and incentive programs	1,10	The institution offers financial and non-financial support and incentive programs to students in addition to the standard services (Y/N)
i3	Landscape Management	2,12	- The institution has sustainable landscape management practices (ex. Plant and soil stewardship, hydrology and water use, etc.) (Y/N) - The total amount of land within the institutional boundary (acres/hectares)
i4	Sustainable Dining	2,12	- The institution has a published sustainable dining policy (Y/N)

Code	Indicator	Related SDG	Suggested aspects for evaluation
			<ul style="list-style-type: none"> - Amount of food waste at university as percentage of food purchased or produced - Distance of food supplier from the university
i5	Education, training, counselling, prevention, and risk-control programs	3,4,8	The institution has education, training, counselling, prevention, and risk-control programs (Y/N)
i6	Health services	3,8	The institution offers occupational health services (e.g. medical services for all the academic community) (Y/N)
i7	Indoor air quality	3	The institution has indoor air quality standards and practices (Y/N)
i8	Cultural or scientific initiatives	4,17	The institution promotes cultural or scientific initiatives targeting the outside community (e.g., open day, science week) (Y/N)
i9	Outreach Materials and Publications	4	<ul style="list-style-type: none"> - The institution produces outreach materials and/or publications that foster sustainability learning and knowledge (Y/N) - Percentage of publications and/or outreach materials related to sustainability
i10	Student Life	4	The institution has one or more co-curricular sustainability programs or initiatives in relation to sustainability (Y/N)
i11	The extent to which the department is involved in the area of sustainability	4,9,17	The department adopts sustainable practices (Y/N)
i12	Grants and contracts specifying sustainability-related research	4,9,16	Percentage of Grants and contracts specifying sustainability-related research
i13	Open Access to Research	4,16	<ul style="list-style-type: none"> - The institution has a formally adopted open access policy (Y/N) - Estimated percentage of scholarly articles published annually by the institution's faculty and staff that are deposited in a designated open access repository (0-100)
i14	Level of sustainable development in the department's research outputs	4,9	Percentage of research addressing sustainable development
i15	SD research publications, projects, programs, and faculty/centres	4,9	Percentage of research publications, projects, programs, and faculty/centres addressing sustainable development
i16	Campus as a Living Laboratory	4,9	<ul style="list-style-type: none"> - The institution uses its campus as a living laboratory for multidisciplinary student learning and applied research in relation to sustainability (Y/N) - Number of substantive work by students and/or faculty (e.g., class projects, thesis projects, papers, published papers) that involves active and experiential learning
i17	Policies related to sustainability in curriculum	4,17	The institution integrates sustainability topics among courses curricula
i18	Programs for skills management and lifelong learning	4,8	The institution encourages programs for skills management and lifelong learning (Y/N)
i19	Training activities for students in course curricula (Soft skills)	4	The institution promotes training activities for students in course curricula (Soft skills) (Y/N)
i20	Sustainability Literacy Assessment	4	<ul style="list-style-type: none"> - The institution conducts an assessment of the sustainability literacy of its students. The sustainability literacy assessment focuses on knowledge of sustainability topics and challenges (Y/N) - Administering a pre- and post-assessment to the institution's predominant student body (e.g., all undergraduate students), directly or by representative sample.
i21	The level of expertise of staff members in the area of sustainability	4	Percentage of staff members that have attended to at least one course/event related to sustainability (0-100)
i22	Graduate Program	4	The institution offers an interdisciplinary academic program that concentrates on sustainability as an integrated concept, including its social, economic, and environmental dimensions for graduate students (Y/N)
i23	Availability of e-learning programs	4	The institution has online short/long courses (Y/N)
i24	Continuing Education	4	Institution encourages continuous education offering courses that embrace citizens, students, workers, etc.
i25	Specific course to "Educate the Educators" in SD	4	<ul style="list-style-type: none"> - Institution qualify its educators to teach SD (Y/N) - Percentage of educators that have attend a course related to SD teaching

Code	Indicator	Related SDG	Suggested aspects for evaluation
i26	Immersive Experience	4	The institution offers at least one immersive, sustainability-focused educational study program. The program is one week or more in length and may take place off-campus, overseas, or on-campus (Y/N)
i27	Sustainable Procurement	4,12	The institution has written policies, guidelines or directives that seek to support sustainable purchasing across commodity categories institution-wide (Y/N)
i28	The level of support given to HEI on sustainability programmes	4,16,17	Percentage of external support (human resources, financial assistance, materials given...) on sustainability programmes
i29	Participatory Governance	4,16,17	Institution has adopted a framework for engaging internal stakeholders (i.e., students, staff, faculty) in governance (Y/N)
i30	Affordability and Access	4,10	Institution has policies and programs in place to make it accessible and affordable to low-income students and/or to support non-traditional students (Y/N)
i31	Fosters the professional and personal development and valorisation of employees	4,8	The institution fosters the professional and personal development and valorisation of employees (e.g. vocational training, academic training) (Y/N)
i32	Student Commute Modal Split	4	Institution's students commute to and from campus using more sustainable commuting options such as walking, bicycling, vanpooling or carpooling, taking public transportation, riding motorcycles or scooters, riding a campus shuttle (Y/N)
i33	Total number of students by faculty, by gender and migration status	5,10	Amount of students specified by faculty, by gender and migration
i34	Assessing Diversity and Equity	5,10	The institution has a structured assessment process during the previous three years to improve diversity, equity, and inclusion on campus (Y/N)
i35	Water conservation practices	6,12	The institution has efficient showerheads and irrigation systems (Y/N)
i36	Rainwater Management	6,9,11	The institution uses green infrastructure and low impact development (LID) practices to help mitigate stormwater run-off impacts and treat rainwater as a resource rather than as a waste product (Y/N)
i37	Water recycling program implementation	6	The institution has a recycling program (Y/N)
i38	Practices to reduce water consumption	6	The institution promotes practices to reduce water consumption (e.g., taps with timer function, flushes with less water, making use of rainwater) (Y/N)
i39	Total water withdrawal by source.	6	Amount (flow/volume) of water consumed by source
i40	Clean and Renewable Energy	7,13	- The institution supports the development and use of clean and renewable energy sources (Y/N) - Total clean and renewable electricity generated on-site during the performance year and for which the institution retains or has retired the associated environmental attributes (MMBtu)
i41	Energy consumption	7	Direct and indirect energy consumption by primary energy source
i42	Energy efficient equipment	7	The institution uses energy efficient-equipment (e.g., efficient heaters, solar panels, energy-saving light bulbs) (Y/N)
i43	Significant financial assistance received from government.	8,10,17	Significant financial assistance received from government
i44	Total workforce by employment type	8	Total workforce by employment type, employment contract, and region, broken down by gender.
i45	Elements of green building	9,11,12	The institution has certified buildings (Y/N)
i46	Building Design and Construction Operations and Maintenance	9,11	Institution owns and operates buildings that are 1) certified under a green building rating system for existing buildings (e.g. LEED O+M) or 2) operated and maintained in accordance with formally adopted sustainable operations and maintenance guidelines and policies. (Y/N)
i47	Support for Sustainable Transportation	9,11	The institution has implemented one or more of the following strategies to encourage more sustainable modes of transportation and reduce the impact of student and employee commuting (Y/N)
i48	Development of technologies and registers patents in the area	9	The institution promotes the development of technologies and registers patents in the area of SD (Y/N)
i49	Support for Research	9	The institution has an ongoing program to encourage students in multiple disciplines or academic programs to conduct research in sustainability (Y/N)

Code	Indicator	Related SDG	Suggested aspects for evaluation
i50	Outdoor Air Quality	11,13,15	The institution has 1) adopted policies or guidelines to improve outdoor air quality and minimize air pollutant emissions from mobile sources on campus and/or 2) completed an inventory of significant air emissions from stationary sources on campus (Y/N)
i51	Total area on campus for water absorption	11,15	Total open space area divided by total campus population
i52	Organic and Inorganic waste treatment	11,12	- Proportion of university waste safely treated, categorized by waste treatment - Total amount of waste produced at university categorized type (paper, food waste, etc.) in relation to total number of students and staff and percentage of waste that is recycled or reused
i53	Waste Minimization and Diversion	12	- The institution has implemented source reduction strategies to reduce the total amount of waste generated (materials diverted + materials disposed) per weighted campus user compared to a baseline (Y/N) - The institution diverts materials from the landfill or incinerator by recycling, composting, donating or re-selling (0-100)
i54	Hazardous Waste Management	12	Amount of hazardous waste produced at university per student and staff and percentage of hazardous waste safely treated by type and treatment
i55	Greenhouse Gas Emissions	13	Total direct and indirect greenhouse gas emissions by weight.
i56	Conservation of biodiversity on and around the campus	14,15	The institution promotes the conservation of biodiversity on and around the campus (Y/N)
i57	Sustainability Coordination	16,17	There is a sustainability department at the institution (Y/N)
i58	Sustainable Investment	16,17	- The institution has one or more co-curricular sustainability programs or initiatives (Y/N) - Estimated percentage of students that participate annually in sustainability-focused co-curricular education and outreach programs (0-100)
i59	Incorporation of sustainable development in institutional policies	16,17	The institution has institutional policies related to sustainability (Y/N)
i60	Investment Disclosure:	16	The institution makes a snapshot of its investment holdings available to the public (Y/N)
i61	Sustainability related presence on the web	17	- There is a sustainable content available on institutions website (Y/N) - There are sustainability-related projects, publications, events shares on institutions website/ social media (Y/N)

4.2 Importance of the selected indicators

Figure 4 presents the relation between indicators and the SDGs, as well as the relevance percentage given by the experts. Indicators may relate to more than one goal (United Nations, n.d.).

All indicators scored at least half of the highest possible score. Indicators i38 (Practices to reduce water consumption) and i54 (Hazardous Waste Management) obtained the highest possible scores. They are both operational indicators and are related to only one SDG (6 and 12, respectively). This focus is reinforced by Point 4 (Undertake a review of policy, infrastructure and protocols on campus to embed a culture and practice of ‘Reduce, Reuse, Recycle’) of the 10 Point Plan from the Big Tent Consortium (2018), a global network of universities and their community partners.

Indicator i30 (Affordability and Access) could contribute to two SDGs (4 and 10) and reached 97% of the maximum possible score, indicating that accessibility issues are among the most relevant in the relationship between HEIs and the SDGs. It demonstrates inclusion, a highlight of the SDGs, as affirmed by the United-Nations Secretary-General Ban Ki-Moon: “the most inclusive and transparent development agenda the world has ever seen” (United Nations Millennium Campaign 2015).

Figure 4. Level of importance (in %) of each indicator for measuring HEIs' contribution to the SDGs

[illegible]

Indicator	SDGs																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
i43								60		50						63	58
i44								73									73
i45								80		73	96						83
i46								65		65							65
i47								80		88							84
i48								85									85
i49								90									90
i50										75		94		60			76
i51										80				73			76
i52										78	100						89
i53											96						96
i54											100						100
i55												80					80
i56													64	93			78
i57															73	83	78
i58															80	83	81
i59															100	93	96
i60															73		73
i61																83	83

Legend:

0-50	51-60	61-70	71-80	81-90	91-100
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Considering inclusive education, the scenario is positive, as stated by Bangladesh's representative at the 7th ASEM Education Ministers' Meeting; "inclusive education is gaining ground, all education indicators confirm improvement" (ASEM Education Secretariat 2019). This confirms that the institutions of education are progressing towards the achievement of the goals.

The fifth most relevant indicator of the whole list is the presence of sustainable development in institutional policies and the influence of local, national and global issues facing the decision-making process of HEI (i59 - Sustainable development in institutional policies). This also represents the scope of the indicator to contemplate all people, as it is useful to measure HEIs contribution towards SDGs 16 and 17.

On the other hand, i43 (Financial assistance) was the indicator with the lowest score. It is linked to three SDGs (8, 10 and 17). Of the total, 11 experts believed that financial assistance received from the government is not so important when evaluating the contribution of HEIs to the SDGs.

The second lowest score was observed for i46 (Building Design and Construction Operations and Maintenance), regarding the operations and maintenance of buildings, and it is related to SDGs 9 and 11. The reason for such a low score is likely to be that other operational indicators better address these goals, such as support for research (i49) and support for sustainable transportation (i47).

4.3 Relation among selected indicators and the HEIs dimensions

The emphasis given to SDG 4 in terms of number of associated indicators refers to its commitment towards Quality Education - one of the core functions of HEIs (UNESCO 2017). For this reason, it was expected that this goal would obtain the highest number of words related to the university role, and, consequently, a greater number of indicators. Another highlight is the number of indicators related to SDG 9 (Industry, Innovation and Infrastructure), which deals with another important university dimension: research (Gimenez 2017). As a result, the probability of more correlated words between the indicators and the SDGs 4 and 9 would be higher.

Among the university's dimensions, the one with the highest number of indicators was campus operations (Table 5), since many indicators focus on operations carried out in the campus structure (Gazzoni et al. 2018). The SDGs that demand this type of indicators the most are 2, 6, 7, 9, 11, 12, 13, 14 and 15, representing more than half of the goals. It may be related to the fact that those indicators are collected in the field and most of them are quantitative. Slaymark (2018, p.33) also supports this connection, by stating that “sustainable practices within operation and administration must, for instance, address the HEIs’ energy and material consumption, emissions, waste management, and transport strategy.”

Table 5. Classification of indicators according to university dimension

Dimension	CAMPUS	TEACHING	OUTREACH	MANAGEMENT	RESEARCH
Codes	i3; i4; i7; i27; i35; i36; i37; i38; i39; i40; i41; i42; i45; i46; i47; i50; i51; i52; i53; i54; i55; i56	i16; i17; i18; i19; i20; i21; i22; i23; i24; i25; i26	i1; i8; i9; i10	i2; i5; i6; i28; i29; i30; i31; i32; i33; i34; i43; i44; i57; i58; i59; i60; i61	i11; i12; i13; i14; i15; i48; i49
n	22	11	4	17	7
Average importance per dimension	85	88	85	82	83

Secondly, there is the management dimension, since decisions made by managers are critical in the contribution of HEIs to SDGs. The goals that mostly demand this type of action are: 1, 3, 4, 5, 8, 10, 16 and 17, representing 47% of the SDGs.

Teaching is the dimension of the university with the third most indicators and it is strongly linked to SDG 4. On the other hand, this is the dimension with the highest associated importance, based on the average of indicators’ importance. SDG 8, 9 and 17 present indicators related to teaching, but in all of them this indicator is also present in SDG 4. Thus, there is no indicator of the dimension that does not belong to the goal of Quality Education.

The research dimension is mainly present in SDGs 4 and 9, which are focused on the main activities of HEIs: education/teaching and research. SDSN (2017) shows that teaching and research are the two main roles of the HEIs with more direct relation to SDGs targets. This dimension appears in one indicator for SDG 16 and another one for SDG 17. These indicators are the same as those mentioned in the SDGs mentioned above; therefore, there is no indicator of the research dimension that does not belong to SDG 4

and 9. Slaymark (2018) states that much research has been done concerning the definition of sustainable development, but now it is imperative to research the pathways of implementation and operationalization of the SDGs. Living labs could work as a link to this. As HEIs are compared to “small towns”, they allow the experience of the “real world” practicing the theory (Evans *et al.*, 2015; SDSN, 2017; Adams *et al.*, 2018).

On the other hand, the outreach dimension is the one that has the least number of indicators, but they are associated with SDGs 1, 4, 8 and 17, demonstrating HEIs’ social responsibility (Nunes, Pereira and Pinho 2017). Regardless of the number of indicators in each university dimension, it is important to implement indicators in all university dimensions to incorporate the necessary transformation in society (Koester *et al.*, 2006; Karatzoglou, 2013; Dagiliūtė *et al.*, 2018;)

5 Conclusions

Higher Education Institutions have great potential to contribute to the achievement of the targets of the Sustainable Development Goals, and therefore must have indicators to evaluate their contribution. The difficulty in adapting the original Agenda 2030 indicators to the context of HEIs is acknowledged; therefore, other indicators could be adopted, as suggested by this study (Table 4). This list shows that HEIs might not need new indicators.

This paper demonstrates that the sustainable development indicators are already present in the literature can be directly related to achievement of the SDGs. Thus, after collecting 432 indicators referenced in the literature, and selecting 268 that contained the most frequently used keywords of SDG, 61 indicators were refined to compose a set of indicators that could follow the evolution of SDGs in HEIs.

The practical implications of this study refer mostly to the support provided to HEIs that are already monitoring sustainability indicators (as used by several tools), and that can “add” the component of contribution towards the 2030 Agenda as well, without having to explore a totally new tool to measure that contribution – especially for institutions that do not have [human/financial] resources to invest in additional levels of monitoring. Although the scope is dedicated to HEIs, the experience of this investigation can be indirectly useful to other sectors – that could use the same approach to adjust their existing monitoring frameworks to add the component of contribution to the 2030 Agenda – and to stakeholders of HEIs, that will benefit from more efforts in all dimensions, especially teaching, outreach and research.

The methodological step of checking the importance of the selected indicators by using a questionnaire aimed at collecting the maximum number of responses could be considered as a limitation of this study since we did not focus on having a proportional number for each global region. In addition, the questionnaire was designed to be concise and to quickly investigate the importance of indicators in measuring the SDGs. Certainly, more questions could have been added, but the authors chose to focus on this approach at this time and avoid sending a questionnaire too long.

This research carried out a survey of indicators published in the literature and focused on sustainability in HEIs. However, there are other indicators that might not have been captured in the literature search and that are still within the scope of the SDGs, such as

those concerning university social responsibility. Therefore, as a suggestion for future work, it is proposed to expand the sources of indicators, using not only those focused on sustainable development in HEIs. Another recommendation for future studies refers to the investigation on whether SDG-related sustainability indicators or institution-specific sustainability indicators have different levels of monitoring effectiveness in HEIs.

It is also important to verify the applicability of the proposed list in different university contexts, which may result in different indicators or adaptations to cover HEIs' particularities, also to make possible and feasible data collection to the specific context.

In fact, HEIs already contribute to global improvements in various aspects and they are already contributing to the achievement of the Sustainable Development Goals. In this context, the indicators become tools to help measure and visualise the effectiveness of the actions carried out by HEIs and guide future decisions. As the set of proposed indicators was already being used even before the development of the 2030 Agenda, it is expected that it will keep being useful to future sustainability agendas.

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Appendix A: Questionnaire

EVALUATION OF SUSTAINABLE DEVELOPMENT GOALS INDICATORS FOR HIGHER EDUCATION INSTITUTIONS

General data

1. Which is your institution?

2. What is your main area of interest?

3. What is your degree level?

☐ Bachelor's Degree

☐ Master's Degree

☐ Doctoral Degree

☐ Other: _____

4. What is your role at the University?

☐ Researcher

☐ Department coordinator

☐ Teacher

☐ Student

☐ Other: _____

Choose one SDG:

Goal 1: End poverty in all its forms everywhere



Goal 2: Zero Hunger



Goal 3: Ensure healthy lives and promote well-being for all at all ages



Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all



Goal 5: Achieve gender equality and empower all women and girls



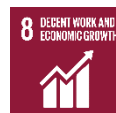
Goal 6: Ensure availability and sustainable management of water and sanitation for all



Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all



Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all



Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation



Goal 10: Reduce inequality within and among countries



Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable



Goal 12: Ensure sustainable consumption and production patterns



Goal 13: Take urgent action to combat climate change and its impacts



Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development



Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse



Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive



Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development



Example of one SDG:

Goal 1 - End poverty in all its forms everywhere



Degree of importance of the indicator to measure this SDG in HEI

- 1) Student, faculty and staff contributions to community

	1	2	3	4	5	
Not important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very important

- 2) Offers financial and non-financial support and incentive programs to students in addition to the standard services

	1	2	3	4	5	
Not important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very important

Thank you for your contribution!